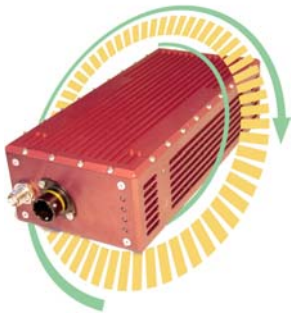
RT-CAN

CAN Interface for the RT3000

RT-CAN User Manual



Confidently. Accurately.

Legal Notice

Information furnished is believed to be accurate and reliable. However, Oxford Technical Solutions Limited assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Oxford Technical Solutions Limited. Specifications mentioned in this publication are subject to change without notice and do not represent a commitment on the part of Oxford Technical Solutions Limited. This publication supersedes and replaces all information previously supplied. Oxford Technical Solutions Limited products are not authorised for use as critical components in life support devices or systems without express written approval of Oxford Technical Solutions Limited.

All brand names are trademarks of their respective holders.

Copyright Notice

© Copyright 2003, Oxford Technical Solutions.

Revision

Document Revision: 030429 *(See Revision History for detailed information).*

Contact Details

Oxford Technical Solutions Limited
77 Heyford Park
Upper Heyford
Oxfordshire
OX25 5HD

Tel: +44 (0) 1869 238 015
Fax: +44 (0) 1869 238 016

http://www.oxts.co.uk
mailto:info@oxts.co.uk

Table of Contents

Introduction 4

Scope of Delivery 5

Specification 6

Warranty 7

Operation 8

- CAN Wiring 9
- RT3000 Configuration 9
- Power LED 9

CAN Messages and Signals 10

- CAN-DB File 10
- CAN Bus Messages 11
- Table Heading Definitions 11
- Signals 12

Revision History 16

Drawing List 17

Introduction

The RT-CAN unit is an interface converter that accepts the RT3000 NCOM output and converts it for transmission over a CAN interface. The RT-CAN unit outputs CAN messages with the following information in them:

- Time
- Position (Latitude, Longitude, Altitude)
- Velocity
- Acceleration
- Heading, Pitch, Roll
- Angular Rates
- RT3000 Status Information
- Slip Angle

There are four main areas that need to be considered when using an RT-CAN unit, these are:

- The configuration of the RT3000
- Wiring
- RT-CAN operation
- The CAN output identifiers and messages.

This User Manual explains each of these areas in turn.

Scope of Delivery

Table 1, below, lists all the items that are delivered with each RT-CAN unit.

Table 1. Summary of the RT-CAN Components

Qty	Description
1	RT-CAN Unit
1	77C0002B Power Cable
1	RS232 Null Modem Serial Cable (FEC976-880)

Figure 1. RT-CAN Components

Specification

The outline technical specification of the RT-CAN unit is shown in Table 2, below.

Table 2. Technical Specification

Parameter	Specification
Input	RS232, NCOM packet at 115,200 baud
Calculation Delay	19.9 ms from RT3000 sample period
Outputs	CAN, TTL (Speed)
Output Rate	100 Hz
Output (CAN)	500 Kbit/s, 11-bit identifiers from 0x500 to 0x60F, non-isolated. (1 MBit/s optional)
Output (TTL)	400 pulses per m, $V_{OL} < 0.4V$, $V_{OH} > 3.6V$, $I_O < 10$ mA
Power	3W, 9 – 18V d.c.
Operating Temperature	0 to 60°C
Relative Humidity	95%, non-condensing
Shock (Survival)	1000g, 5 ms half-sine

Warranty

Oxford Technical Solutions Limited warrants the RT3000 products to be free of defects in materials and workmanship, subject to the conditions set forth below, for a period of one year from the Date of Sale.

'Date of Sale' shall mean the date of the Oxford Technical Solutions Limited invoice issued on delivery of the product. The responsibility of Oxford Technical Solutions Limited in respect of this warranty is limited solely to product replacement or product repair at an authorised location only. Determination of replacement or repair will be made by Oxford Technical Solutions Limited personnel or by personnel expressly authorised by Oxford Technical Solutions Limited for this purpose.

In no event will Oxford Technical Solutions Limited be liable for any indirect, incidental, special or consequential damages whether through tort, contract or otherwise. This warranty is expressly in lieu of all other warranties, expressed or implied, including without limitation the implied warranties of merchantability or fitness for a particular purpose. The foregoing states the entire liability of Oxford Technical Solutions Limited with respect to the products herein.

Operation

There are no configuration options for the RT-CAN system. To operate the unit connect the RT-CAN RT3000 (serial) input to one of the outputs of the RT3000 system using the Null Modem Serial Cable provided. Connect the 77C0002B Power Cable to the Power input and provide power. Connect the CAN output the CAN bus. If the TTL output is required, connect it to the correct pins on the CAN output connector.

Table 3, below, gives details of the CAN output connector.

Table 3. CAN Connector Pin Assignments – 15-way connector

Pin	Description
5	Ground
10	Ground
11	TTL Out
12	CAN+ (CAN High)
13	CAN- (CAN Low)
Case	EMC screen. Connected to the case.
	All other pins are reserved. Do not connect to them.

Multiple grounds are provided for the convenience of wiring. Either ground can be used.

Table 4. CAN Connector Pin Assignments – 9-way connector

Pin	Description
3	Ground
5	Ground
8	TTL Out
7	CAN+ (CAN High)
2	CAN- (CAN Low)
Case	EMC screen. Connected to the case.
	All other pins are reserved. Do not connect to them.

Multiple grounds are provided for the convenience of wiring. Either ground can be used.

CAN Wiring

The RT-CAN unit does not include a termination resistor. It is essential to include a 120Ω resistor at each end of your CAN bus. Otherwise the CAN bus will not work.

RT3000 Configuration

For correct operation of the RT-CAN unit, the RT3000 must be configured to output an NCOM message at 100Hz, 115,200 baud. If the RT3000 has two available serial ports then either one can be used to output the NCOM message.

Power LED

The Power LED will be Green when power is applied. The LED will flash Orange/Green when valid NCOM data is decoded and time is valid on the NCOM output. If NCOM data is interrupted then the Power LED will stop (on either Green or Orange).

CAN Messages and Signals

The RT-CAN uses identifiers 500h to 5FFh for RT3000 Status Information and 600h to 60Fh for navigation information.

All values from the RT3000 are encoded in Little-Endian format (Intel-style).

For details on the RT3000 Status Information, contact Oxford Technical Solutions. This set of identifiers covers information such as accuracy, GPS tracking, calibration, etc. Not all of the identifiers are used, but they are all reserved for future use.

CAN-DB File

A CAN-DB file is available for download on the Oxford Technical Solutions web site. This file contains definitions for the Status messages as well as the Measurement outputs. Only the Measurement outputs are described here.

CAN Bus Messages

Table 5. CAN Bus Messages

Identifier (hex)	Data Contents	See Table
500h to 5FFh	Reserved for RT3000 Status Information	Contact Oxford Technical Solutions
600h	Date and Time	Table 6
601h	Latitude, Longitude	Table 7
602h	Altitude	Table 8
603h	Velocity (North East Down)	Table 9
604h	Reserved. (Future implementations will output Forward/Lateral Velocity)	
605h	Accelerations (body X, Y, Z)	Table 10
606h	Reserved. (Future implementations will output Forward, Lateral and Downward Accelerations)	
607h	Heading, Pitch Roll	Table 11
608h	Angular Rates (body X, Y, Z)	Table 12
609h	Reserved. (Future implementations will output Forward, Lateral and Downward Angular Rates)	
60Ah	Slip Angle, Track Angle	Table 13
60Bh	Distance	Table 14
60Ch to 60Fh	Reserved for future use	

Table Heading Definitions

The fields in the tables have the following meanings.

Offset (bits). This is the offset into the Message where the Signal starts. To compute the offset in bytes divide the value by 8.

Length (bits). This is the length of the Signal in bits. To compute the length of the Signal in bytes, divide the value by 8.

Type. This specifies either an unsigned value (U) or a signed value (S).

Units. This is the units for the signal.

Factor. This it the factor that the integer unit should be multiplied by to get the Signal into the units given in the table.

Offset. This is the value of the Signal when the integer value in the CAN message is zero. It is zero for all the RT3000 signals and can usually be discarded.

Signals

The following tables describe the signals in each of the messages.

Table 6. Identifier 600h, Date and Time

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	8	U	year	1	0	Year within century (e.g. '2' during year 2002)
8	8	U	year	100	0	Century (e.g. '20' during 2002)
16	8	U	month	1	0	Month
24	8	U	day	1	0	Day
32	8	U	s	0.01	0	Hundredths of a Second
40	8	U	s	1	0	Seconds
48	8	U	min	1	0	Minutes
56	8	U	hour	1	0	Hours

Note: Time is always reported as GPS time. Currently this is 13 seconds different from UTC

Table 7. Identifier 601h, Latitude and Longitude

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	32	S	degrees	1e-7	0	Latitude
32	32	S	degrees	1e-7	0	Longitude

Table 8. Identifier 602h, Altitude

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	32	S	m	0.001	0	Attitude

Table 9. Identifier 603h, Velocity

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	16	S	m/s	0.01	0	North Velocity
16	16	S	m/s	0.01	0	East Velocity
32	16	S	m/s	0.01	0	Down Velocity
48	16	S	m/s	0.01	0	Speed

Table 10. Identifier 605h, Body Accelerations

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	16	S	m/s^2	0.01	0	Body X-Acceleration
16	16	S	m/s^2	0.01	0	Body Y-Acceleration
32	16	S	m/s^2	0.01	0	Body Z-Acceleration

Table 11. Identifier 607h, Heading, Pitch, Roll

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	16	U	degrees	0.01	0	Heading
16	16	S	degrees	0.01	0	Pitch
32	16	S	degrees	0.01	0	Roll

Note: the range of Heading is 0 to 360 degrees; the range of pitch is ±90 degrees; the range of roll is ±180 degrees.

Table 12. Identifier 608h, Body X, Y, Z Angular Rates

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	16	S	deg/s	0.01	0	Body X-Angular Rate
16	16	S	deg/s	0.01	0	Body Y-Angular Rate
32	16	S	deg/s	0.01	0	Body Z-Angular Rate

Table 13. Identifier 60Ah, Track, Slip Angles

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	16	S	degrees	0.01	0	Track Angle
16	16	S	degress	0.01	0	Slip Angle

Table 14. Identifier 60Bh, Distance

Offset (bits)	Length (bits)	Type	Units	Factor	Offset	Description
0	32	U	m	0.001	0	Distance with Hold
32	32	U	m	0.001	0	Distance

Note: The “Distance with Hold” will not increase when the RT3000 measures a speed less than 0.2m/s whereas the “Distance” field will drift by the noise of the RT3000 when stationary. The distances start from zero when the RT-CAN unit is powered up.

Revision History

Table 15. Revision History

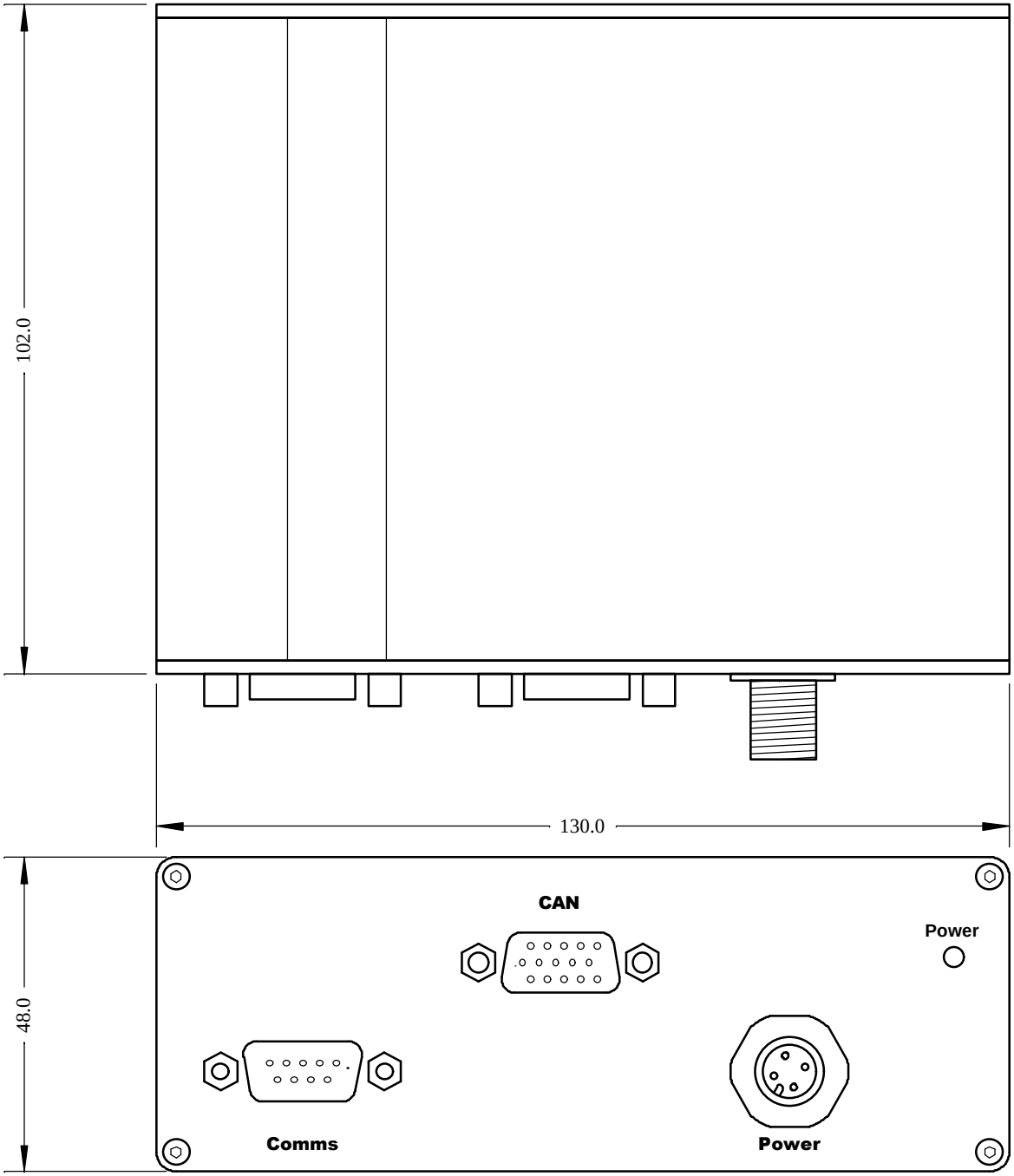
Revision	Comments
020705	Initial Version
020718	Corrected error in velocity units (Table 9). Typing error corrections.
021022	Updated for new CAN-DB File and changed presentation for Signals
021111	Added Distance outputs. Active with software versions 021111.14af onwards.
030429	Changed default CAN baud to 500 kbit/s. Added Speed to CAN outputs. Added pin connections for 9-way connector.

Drawing List

Table 16, below, lists the available drawings that describe components of the RT-CAN system. Many of these drawings are attached to the back of this manual. Note that the '*x*' following a drawing number is the revision code for the part. If you require a drawing, or different revision of a drawing, that is not here then contact Oxford Technical Solutions.

Table 16. List of Available Drawings

Drawing	Description
14A0012A	RT-CAN Dimensions
77C0002B	Power Cable
FEC976-880	Null Modem Serial Cable



Oxford Technical Solutions
77 Heyford Park
Upper Heyford
Oxfordshire
OX25 5HD
www.ots.ndirect.co.uk

© Copyright Oxford Technical Solutions, 2001

Confidential Information

The information in this document is confidential and must not be disclosed to other parties or used to build the described components without the written permission of Oxford Technical Solutions.

0 10 20 30

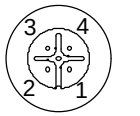
Print Size:	A4
Scale:	1:1
Units:	mm
Tolerances:	X.X – 0.5
Projection:	3rd Angle
Notes:	
Date:	05/07/02
Part #:	14A0012A
Document:	RT-CAN Dimensions
Sheet:	1 of 1

Oxford Technical Solutions
77 Heyford Park
Upper Heyford
Oxfordshire
OX25 5HD
www.ots.ndirect.co.uk

© Copyright Oxford Technical Solutions, 2002

Confidential Information

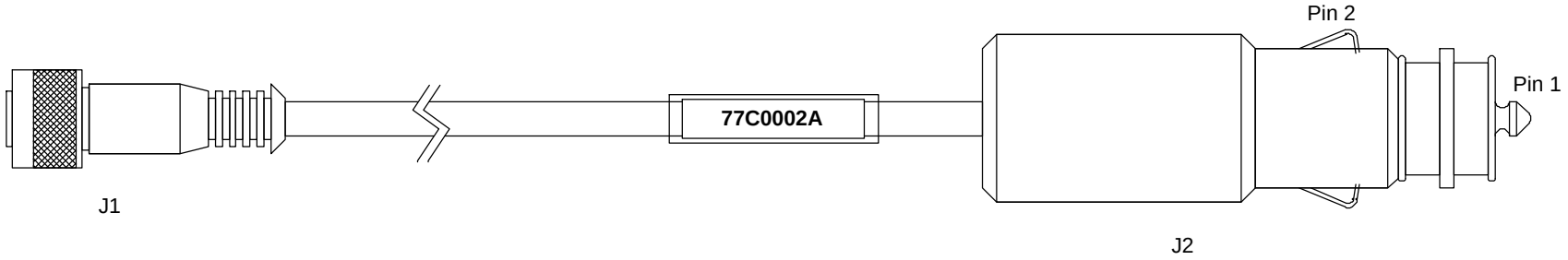
The information in this document is confidential and must not be disclosed to other parties or used to build the described components without the written permission of Oxford Technical Solutions.



View from front of socket

Pin Definitions

J1-1 (Brown) Positive 12V Power supply (9–18V d.c.)
J1-2 (White) Positive 12V Power/Charger supply (11–18V d.c.)
J1-3 (Blue) 0V/GND
J1-4 (Black) 0V/GND



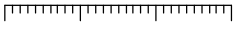
Parts

RS291-5881 M12 4w 5m PVC straight Connector
FEC 658-376 Car Cigarette Lighter Plug
RS399-524 Yellow Heat Shrink 6.4mm
RS399-934 Clear Heat Shrink 6.4mm

(Alternative Part: RS 266-0250
Car Cigarette Lighter Plug - 8A fused)

Connections

J1-1 (Brown) – J2-1
J1-2 (White) – J2-1
J1-3 (Blue) – J2-2
J1-4 (Black) – J2-2



Print Size:	A4
Scale:	1:1
Units:	mm
Tolerances:	1mm
Projection:	N/A

Notes:

10/04/02
Alternative Part Number added

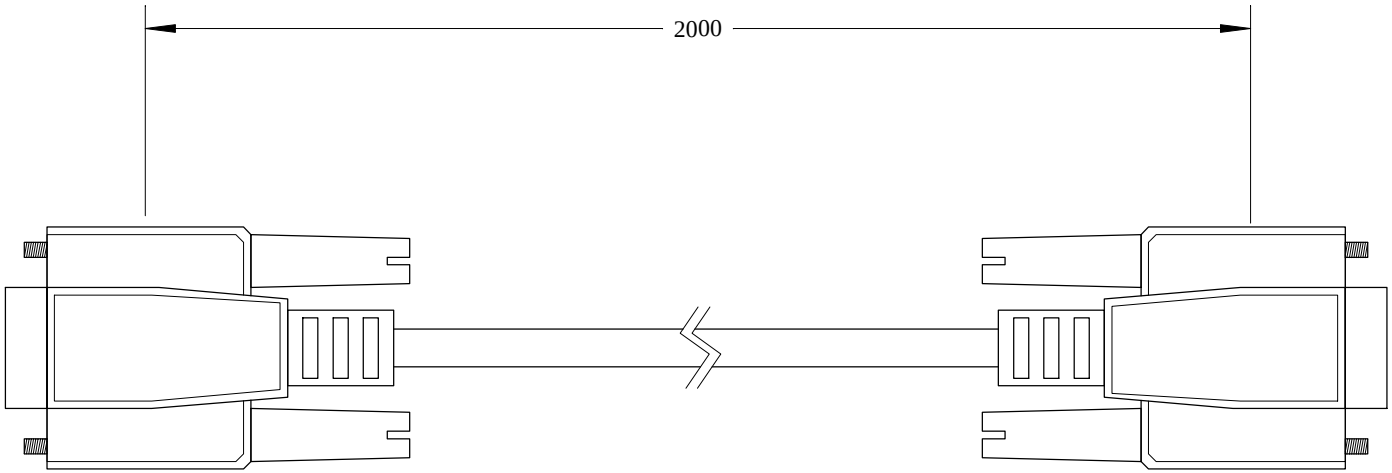
Date:	26/06/02
Part #:	77C0002B
Document:	MicroSAT Power Cable
Sheet:	1 of 1

Oxford Technical Solutions
77 Heyford Park
Upper Heyford
Oxfordshire
OX25 5HD
www.ots.ndirect.co.uk

© Copyright Oxford Technical Solutions, 2001

Confidential Information

The information in this document is confidential and must not be disclosed to other parties or used to build the described components without the written permission of Oxford Technical Solutions.



0 10 20 30

Print Size:	A4
Scale:	1:1
Units:	mm
Tolerances:	10 mm
Projection:	3rd Angle

Notes:

Date:	21/08/01
Part #:	FEC 976-880
Document:	9-way Null Modem Cable
Sheet:	1 of 1